

## Memorandum



EAD

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DATE : January 7, 1983

TO : Walt Sickler

FROM : Katherine Fletcher, Mary Jo Henderson

SUBJECT : Employee Concerns about PCB

Your memorandum of December 6 asks for "firm, simple, formal statements" that may be conveyed to employees, specifically gardening crews, concerning their exposure to PCB's. First of all, both Environmental Affairs and the Safety Unit consider it entirely valid for employees to ask questions about chemical substances used on the job. They also understand that it is natural for females to question the use of any substance that may affect pregnancy. Environmental Affairs and the Safety Unit have recently consulted with EPA and NIOSH authorities and reaffirm the previously stated position that gardening crews (male and female), properly protected, do not have a valid basis for refusing to perform emergency clean-up of PCB spills.

Irene Jackson, Safety Unit, met with Dr. Walter Ruch, NIOSH Regional Program Consultant, to discuss the gardeners' concerns and the 1976 NIOSH Recommendations. Dr. Ruch confirmed that the four itemized statements in your December 6 memorandum are correct. He did comment on item #3, however. Although OSHA has not adopted the NIOSH recommendations, PCB's are considered a 'known hazard' and until their use is regulated by an OSHA Standard, if it is, the NIOSH recommendations must be followed. Dr. Ruch verified that City Light's handling and disposal methods are consistent with the intent of the recommendations.

In addition, Dr. Ruch pointed out that the NIOSH recommendations were written for the primary user. That is, they are intended to provide employee protection "for up to a 10 hour work day, a 40 hour work week, and over a normal working lifetime." Industrial exposure is primarily to the skin, which must be protected from splash. Gardeners are called out for PCB cleanup on an emergency basis only. It is our understanding this occurs very infrequently, for example, not for the past 3 years. According to Dr. Ruch, protective measures practiced by City Light are the same as those recommended for consistently exposed workers. For these reasons we see no basis for excusing

Walt Sickler  
January 7, 1983  
Page Two

female or male gardeners from the emergency clean-up task.

The NIOSH document contains a lot of information. We are uncertain if there are particular areas of research which Mary Jean Gilman would want us specifically to confirm or discuss, but we assume the potential impacts on a human fetus would be one. Because the 1976 NIOSH statements concerning adverse effects on a human fetus were based on animal ingestion (they were fed PCB's), Dr. Ruch would like to consult with a medical colleague for expertise on whether subsequent studies have affected the original conclusions. City Light will then be provided with this information. We will obtain further information on any other topics of particular concern to her.

IJ; mlr

cc: Recchi	McArthur
Peha	Macdonald
Jackson	Henderson
Dyckman	
Spitzer	
Fletcher, J.	
EAD (3)	
File	

CTY0069237

SEA315651



DATE : December 6, 1982

DEC 6 1982

TO : Mary Jo Henderson - Attn: Lee Peha  
Katherine Fletcher - Attn: Clare Dykman ✓  
FROM : Walt Sickler

SUBJECT : Employee Concerns About PCB

LOG NO.	
DATE IN	12/6 DATE OUT
ROUTED TO:	Due to MF BY: [initials]

Attached is a letter from Mary Jean Gilman to Ray Naud and the NIOSH document pages that were attached to Mary Jean's letter. Mary Jean works in the gardner crew of North Stations that is assigned responsibility for cleaning up PCB spills. Clare Dykman and Irene Jackson are among those who have discussed the PCB situation with the gardner crew. City Lighters have been studying the PCB problem for many years, and have carefully detailed PCB spills procedure in the Emergency Operations Procedure Operational Plan, Section E.

We need firm, simple, formal statements from you that we can give to our employees that clearly convey the PCB situation at City Light. We think the following statements are true and that you would agree with them. Some recent correspondence is also attached.

1. The NIOSH recommendations published in September 1977 have never been made into law.
2. The NIOSH recommendations have not been revised or updated.
3. OSHA reviewed the NIOSH recommendations, but did not adopt them or request that they be made into laws.
4. Seattle City Light PCB cleanup procedures conform to the NIOSH recommendation. We have done this even though the NIOSH recommendations are not legally required.

Please provide further assistance so we can reply to Mary Jean Gilman's concerns.

AMS:sw

Attachments:

cc: Jackson, I.  
Sickler, W.  
Macdonald, M.

Memo from Mary Jean Gilman 11/17/2  
and its NIOSH Attachment

Memo Lee Peha to Ray Naud 11/23/82

Memo Ray Naud and to M.J. Gilman 12/1/82

To: Walt Sickler  
From: Katherine Fletcher, Mary Jo Henderson  
Subject: Employee Concerns about PCB

Your memorandum of December 6 asks for "firm, simple, formal statements" that may be conveyed to employees, specifically gardening crews, concerning their exposure to PCBs. First of all, both Environmental Affairs and the Safety Unit consider it entirely valid for employees to ask questions about chemical substances used on the job. They also understand that it is natural for females to question the use of any substance that may affect pregnancy. <sup>Env. & Occupational Affairs</sup> ~~OSHA~~ and the Safety Unit have recently consulted with EPA and NIOSH authorities and reaffirm the previously stated position that gardening crews (male and female), properly protected, do not have a valid basis for refusing to perform emergency cleanup of PCB spills.

Irene Jackson, Safety Unit, met with Dr. Walter Ruch, NIOSH Regional Program Consultant, to discuss the gardeners' concerns and the 1976 NIOSH Recommendations. Dr. Ruch confirmed that the four itemized statements in your December 6 memorandum are correct. He did comment on item #3, however. Although OSHA has not adopted the NIOSH recommendations, PCBs are considered a 'known hazard' and until, ~~or if,~~ <sup>if it is,</sup> ~~they~~ their use is regulated by an OSHA Standard, the NIOSH recommendations must be followed. Dr. Ruch verified that City Light's handling and disposal methods are consistent with the intent of the recommendations.

In addition, Dr. Ruch pointed out that the NIOSH recommendations were written for the primary user. That is, they are intended to provide employee protection "for up to a 10 hour work day, a 40 hour work week, and over a normal working lifetime."

Industrial exposure is primarily to the skin, which must be protected from splash.

Gardeners ~~are~~ <sup>only</sup> are called out for PCB cleanup on an emergency basis ~~and~~ <sup>It is our</sup> understanding this <sup>occurs very infrequently, and that not in the past for example, not for</sup> ~~has not occurred in~~ the past 3 years. According to Dr. Ruch, protective measures practiced by City Light are the same as those recommended for

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discuss, but we assume the <sup>in parts on a human fetus</sup> <sup>specifically</sup> ~~parts on a human fetus~~ would be  
one.

consistently exposed workers. For these reasons we see no basis for  
excluding female <sup>or male</sup> gardeners from the ~~the~~ emergency clean-up task.

Because the 1976 NIOSH statements concerning adverse effects on a human fetus  
were based on animal ingestion (they were fed PCBs), Dr. Ruch would like to  
consult with a medical colleague for expertise on whether subsequent studies  
have affected the original conclusions. City Light will <sup>then</sup> be provided with this  
information. We will obtain <sup>further</sup> information on any other topics  
of particular concern to her. **END MEETING**

TP We will provide <sup>further</sup> information to the gardeners ~~concerning~~ regarding  
two subjects: the adverse effects on a human fetus; and PCB  
evaporation rates. We assume, maybe incorrectly, that these  
two areas <sup>might be</sup> ~~are~~ of particular concern. Because...

TP ~~Because the NIOSH document discusses respiration of PCB's by workers~~  
~~in an enclosed area we will provide the gardeners with the volatility~~  
<sup>information</sup>

TP ~~PCB's~~ On a relative scale, ~~PCB's~~ are not considered  
volatile ~~they do not evaporate~~. The NIOSH document indicates  
that PCB's are pervasive in the atmosphere. Our understanding  
is that this is <sup>primarily</sup> the result of <sup>burning</sup> PCB substances. The PCB's have  
been released at high temperatures and have not yet been flushed  
down by the water cycle. <sup>The NIOSH document also indicates workers</sup>  
~~are exposed to breathing PCB's in the work place.~~  
~~clean up a spill on a typical Seattle the temp the PCB oil will~~  
be the temperature of the surrounding soil, <sup>typically</sup> ~~generally~~ not hot  
enough to create high rates of evaporation. ~~On a relative~~  
scale, PCB's are not considered very volatile. ~~For example,~~  
benzene ~~evaporates 10,000~~ is 10,000 times as volatile as  
PCB, trichloroethane is 100 times as volatile.

NIOSH are trying to will  
provide us with this information.

# Memorandum



DATE : December 6, 1982

TO : Mary Jo Henderson - Attn: Lee Peha ✓  
Katherine Fletcher - Attn: Clare Dykman

FROM : Walt Sickler *WS*

SUBJECT : Employee Concerns About PCB

RECEIVED  
DEC 6 1982  
SAFETY

Attached is a letter from Mary Jean Gilman to Ray Naud and the NIOSH document pages that were attached to Mary Jean's letter. Mary Jean works in the gardner crew of North Stations that is assigned responsibility for cleaning up PCB spills. Clare Dykman and Irene Jackson are among those who have discussed the PCB situation with the gardner crew. City Lighters have been studying the PCB problem for many years, and have carefully detailed PCB spills procedure in the Emergency Operations Procedure Operational Plan, Section E.

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Macdonald, M.

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and its NIOSH Attachment

Memo Lee Peha to Ray Naud 11/23/82

Memo Ray Naud and to M.J. Gilman 12/1/82

# Memorandum



DATE : November 23, 1982  
TO : Ray Naud  
FROM : Lee Peha *LP*  
SUBJECT : PCB Cleanup

RECEIVED  
NOV 30 1982  
DIR. OF OPER  
UNIT 801

Apparently several of your employees have expressed concern that they have been assigned the responsibility of cleaning up PCB spills. Employees do have a right to be concerned, because PCBs handled improperly can be a source of illness. As a result, the Safety Unit has researched this subject through NIOSH, OSHA, and the EPA.

NIOSH, in September 1977, published criteria for a recommended standard titled, "Occupational Exposure to Polychlorinated Biphenyls" which has not since been revised. OSHA reviewed these criteria but did not adopt them into law. The EPA is concerned with the disposal of PCB rather than with employee safety. Therefore the only federal or state guideline available to us regarding the exposure of employees to PCBs is the NIOSH report.

This report recommends that because employees will be exposed to PCBs until all supplies are depleted, this workplace exposure must be carefully controlled. The report spells out suggested means to protect the health and provide for the safety of employees "for up to a 10 hour work day, a 40 hour work week, and over a normal working lifetime." Because PCBs do exist in the workplace, handling of this material must be accomplished with the proper protective devices in order to protect the employees' health.

Federal agencies, and the Safety Unit, are convinced that the infrequent exposure of employees to PCBs will not affect their health if they wear protective devices provided by the employer. City Light procedures are spelled out in the Emergency Operations Procedures - Operational Plan, section X. E

I hope the attached information will further assist you and your personnel in handling PCB cleanups.

LP:jj

cc: Sickler  
Fletcher ✓  
Henderson  
Gorohoff  
Peha  
File

# Memorandum



DATE : December 1, 1982  
TO : Mary Jean Gilman  
FROM : R. Naud *R. Naud*  
SUBJECT : P.C.B. Information

RECEIVED  
DEC 2 1982  
DIR. OF OPER  
UNIT 601

Thank you for providing copies of the printed material you made reference to in the meeting with Irene Jackson.

This material was given to Jim Fletcher who is conducting an investigation and will respond to your concern at a later date.

RN:pb

cc: Fletcher ✓  
Safety unit

Nov. 17, 1982

Dear Mr. Naud,

Here are excerpts which I copied from a publication credited at the bottom of the first page.

All statements are supported by data, sources of which are available by consulting the bibliography at the end of the book.

This publication is available through the bookstore in the Federal Office Bldg downtown.

Mary Jean Gilman

(g) Pertinent medical records shall be maintained for all employees exposed to PCBs in the workplace. Such medical records shall be maintained for the period of employment plus 30 years. These records shall be made available to the designated medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, of the employer, and of the employee or former employee.

### Section 3 - Labeling and Posting

All labels and warning signs shall be printed both in English and in the predominant language of non-English-reading workers. Illiterate workers and workers reading languages other than those used on labels and posted signs shall be otherwise informed regarding hazardous areas and shall be informed of the instructions printed on labels and signs.

#### (a) Labeling

The following warning label shall be affixed in a readily visible location on PCB-processing or other equipment, and on PCB-storage tanks or containers:

POLYCHLORINATED BIPHENYLS  
(PCBs)

DANGER! CONTAINS POLYCHLORINATED BIPHENYLS  
CANCER SUSPECT AGENT

Use only with adequate ventilation.  
Do not get in eyes, or on skin or clothing.

First Aid: In case of skin or eye contact, flush with running water.

*from NIOSH Criteria for a Recommended Standard - PCBs  
Pub # DHEW 77-225*

(b) Posting

Warning placards shall be affixed in readily visible locations in or near PCB work areas. The information contained thereon shall be arranged as in the following example.

POLYCHLORINATED BIPHENYLS  
(PCBs)

DANGER!

CANCER SUSPECT AGENT

AUTHORIZED PERSONNEL ONLY

Do not enter unless area is adequately ventilated.  
Do not get in eyes, or on skin or clothing.

First Aid: In case of skin or eye contact, flush with running water.

Section 4 - Personal Protective Equipment and Clothing

(a) Protective Clothing

In any operation where workers may come into direct contact with PCBs, protective clothing impervious to PCBs shall be worn. Gloves, boots, overshoes, and bib-type aprons that cover boot tops shall be provided when necessary. Protective apparel shall be made of materials which most effectively prevent skin contact with PCBs where it is most likely to occur. Employers shall ensure that all personal protective clothing is inspected regularly for defects and that it is in a clean and satisfactory condition.

(b) Eye Protection

Chemical safety goggles, face shields (8-inch minimum) with goggles, or safety glasses with side shields shall be provided by employers and shall be worn during any operation in which PCBs are present. If liquid or

solid PCBs contact the eyes, the eyes shall be irrigated immediately with large quantities of water and then examined by a physician or other responsible medical personnel. (A drop of vegetable oil on the eye has been found to reduce the resultant irritation.) Eye protection shall be in accordance with 29 CFR 1910.133 and ANSI Z 87.1-1968.

(c) Respiratory Protection

(1) Engineering controls shall be used when needed to keep concentrations of airborne PCBs at or below the recommended TWA occupational exposure limit. The only conditions under which compliance with the permissible exposure limit may be achieved by the use of respirators are:

(A) During the time necessary to install or test the required engineering controls.

(B) For nonroutine maintenance or repair activities.

(C) During emergencies when concentrations of airborne PCBs may exceed the permissible limit.

(2) When the use of respirators is permitted by paragraph c(1) of this section, respirators shall be selected and used in accordance with the following requirements:

(A) The employer shall establish and enforce a respiratory protection program meeting the requirements of 29 CFR 1910.134.

(B) The employer shall provide respirators in accordance with Table I-1 and shall ensure that employees properly use the respirators provided. The respirators shall be those approved by NIOSH or the Mining Enforcement and Safety Administration. The standard for approval is specified in 30 CFR 11. The employer shall ensure that

respirators are properly cleaned, maintained, and stored when not in use.

TABLE I-1

RESPIRATOR SELECTION GUIDE

Concentration of PCBs	Respirator Type Approved under Provisions of 30 CFR 11
Greater than 1.0 $\mu\text{g}/\text{cu m}$ or <u>Emergency</u> (entry into area of unknown concentra- tion)	(1) Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode. (2) Combination Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode.

Section 5 - Informing Employees of Hazards from PCBs

(a) All new and present employees in any area in which PCBs are used shall be informed of the hazards, relevant symptoms, and effects of overexposure to PCBs, and the precautions to be observed for safe use and handling of these materials.

(b) All employees involved with the manufacture, use, transport, or storage of PCBs shall be informed that PCBs have been found to induce tumors in experimental animals after repeated oral ingestion and that because of these findings it is concluded that PCBs are potential human carcinogens; employees shall also be informed that adverse reproductive

effects may result from occupational exposure to PCBs.

(c) The employer shall institute a continuing education program, conducted by instructors qualified by experience or training, to ensure that all employees occupationally exposed to PCBs have current knowledge of job hazards, proper maintenance and cleanup methods, and proper use of protective clothing and equipment, including respirators. The instructions shall include a general description of the medical surveillance program and of the advantages to the employee of participation. Special attention shall be given to women in the workplace. They shall be made aware of the potential adverse effects of PCBs on the unborn child, and of the known transport of PCBs to breast milk. Elements of the program shall also include:

- Emergency procedures and drills;
- Instruction in handling spills and leaks;
- Decontamination procedures;
- Firefighting equipment location and use;
- First-aid procedures, equipment location, and use;
- Rescue procedures;
- Confined space entry procedures;
- Low warning (odor) properties of PCBs.

(d) The information explaining the hazards of working with PCBs shall be kept on file and be readily accessible to workers at all places of employment where PCBs are manufactured, used, stored, or transported. Required information shall be recorded on the "Material Safety Data Sheet" shown in Appendix III, or similar form approved by the Occupational Safety and Health Administration, US Department of Labor.

**Section 6 - Work Practices and Engineering Controls**

**(a) Regulated Areas**

Access to PCB work areas shall be regulated and limited to authorized persons. A daily roster shall be kept of persons entering such areas.

**(b) Handling of PCBs and General Work Practices**

(1) Operating instructions shall be formulated and posted where PCBs are handled or used.

(2) Transportation and use of PCBs shall comply with all applicable local, state, and federal regulations.

(3) PCBs shall be stored in tightly closed containers in well-ventilated areas.

(4) When PCB storage containers are being moved, or when they are not in use and are disconnected, valve protection covers shall be in place. Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.

(5) Storage facilities shall be designed to contain spills completely within surrounding dikes and to prevent contamination of workroom air.

(6) Ventilation switches and emergency respiratory equipment shall be located outside storage areas in readily accessible locations which will remain minimally contaminated with PCBs in an emergency.

(7) Process valves and pumps shall be readily accessible and shall not be located in pits or congested areas.

(8) Containers and systems shall be handled and opened with care. Approved protective clothing as specified in Section 4 shall be worn

by employees engaged in opening, connecting, and disconnecting PCB containers and systems. Adequate ventilation shall be provided to minimize exposures of such employees to airborne PCBs.

(9) PCB-operating and storage equipment and systems shall be inspected daily for signs of leaks. All equipment, including valves, fittings, and connections shall be checked for leaks immediately after PCBs are introduced therein.

(10) When a leak is found, it shall be repaired or otherwise corrected immediately. Work shall resume normally only after necessary repair or replacement has been completed, the area has been ventilated, and the concentration of PCBs has been determined by monitoring to be at or below the recommended TWA concentration limit.

(c) Control of Airborne PCBs

(1) Suitable engineering controls, designed to maintain exposure to airborne PCBs at or below the limit prescribed in Section 1(a), shall be used. Complete enclosure of processes is the recommended method for control of PCB exposure. Local exhaust ventilation may also be effective, used alone or in combination with process enclosure. When a local exhaust ventilation system is used, it shall be so designed and operated as to prevent accumulation or recirculation of airborne PCBs in the workplace environment and to effectively remove PCBs from the breathing zones of employees. Exhaust ventilation systems discharging to outside air must conform to applicable local, state, and federal regulations and must not constitute a hazard to employees or to the general population. Before maintenance work on control equipment begins, the generation of airborne PCBs shall be eliminated to the extent feasible.

Enclosures, exhaust hoods, and ductwork shall be kept in good repair so that designed airflows are maintained. Airflow at each hood shall be measured at least semiannually and preferably monthly. Continuous airflow indicators are recommended, such as water or oil manometers properly mounted at the juncture of fume hood and duct throat (marked to indicate acceptable airflow). A log shall be kept showing design airflow and the results of semiannual airflow measurements.

(2) Forced-draft ventilation systems shall be equipped with remote manual controls and shall be designed to shut off automatically in the event of a fire in the PCB work area.

(d) Special Work Areas

(1) PCB Hazard Areas

A hazard area shall be considered as any space having physical characteristics and containing sources of PCBs, such as transformers, that could result in PCB concentrations in excess of the recommended airborne PCB exposure limit. Exits shall be plainly marked, conveniently located, and open outwardly into areas which will remain minimally contaminated in an emergency.

(2) Confined or Enclosed Spaces

Entry into confined or enclosed spaces, such as tanks, pits, process vessels, and tank cars where there is limited egress, shall be controlled by a permit system. Permits shall be signed by an authorized representative of the employer and shall certify that appropriate measures have been taken to prevent adverse effects on the worker's health as a result of his or her entry into such space.

Confined or enclosed spaces which have contained PCBs shall be thoroughly ventilated to assure an adequate supply of oxygen, tested for PCBs and other contaminants, and inspected for compliance with these requirements prior to each entry. Adequate ventilation shall be maintained while workers are in such spaces. Leakage of PCBs into such confined or enclosed spaces while work is in progress shall be prevented by disconnecting and blanking the PCB supply lines. Each individual entering such confined or enclosed space shall be furnished with appropriate personal protective equipment and clothing and be connected by a lifeline harness to a standby worker stationed outside of the space. The standby worker shall also be equipped for entry with approved personal protective equipment and clothing and have contact with a third person. The standby person shall maintain communication (visual, voice, signal line, telephone, radio, or other suitable means) with the employee inside the confined or enclosed space.

(e) Emergency Procedures

For all PCB work areas where there is a potential for the occurrence of emergencies, employers shall take all necessary steps to ensure that employees are instructed in, and follow, the procedures specified below as well as any others appropriate to the specific operation or process.

(1) If PCBs leak or are spilled, the following steps shall be taken:

(A) All nonessential personnel shall be evacuated from the leak or spill area.

(B) The area of the leak or spill shall be adequately ventilated to prevent the accumulation of vapors.

(C) If the PCBs are in liquid form, they shall be collected for reclamation or sorbed in vermiculite, dry sand, earth, or similar nonreactive material.

(2) Personnel entering the spill or leak area shall be furnished with appropriate personal protective equipment and clothing. All other personnel shall be prohibited from entering the area.

(3) Only personnel trained in the emergency procedures and protected against the attendant hazards shall shut off sources of PCBs, clean up spills, control and repair leaks, and fight fires, in areas where PCBs are used.

(4) All wastes and residues containing PCBs shall be collected in PCB-resistant containers and appropriately disposed of (Federal Register 42:26563-77, May 24, 1977).

(5) Safety showers, eyewash fountains, and washroom facilities shall be provided, maintained in working condition, and located so as to be readily accessible to workers in all areas where the occurrence of skin or eye contact with PCBs is likely. If liquid or solid PCBs are splashed or spilled on an employee, contaminated clothing shall be removed promptly and the skin washed thoroughly with soap and water for at least 15 minutes. Eyes shall be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A drop of vegetable oil may be applied to the eye to relieve the irritating effect of PCBs.

#### Section 7 - Sanitation Practices

(a) Employees occupationally exposed to PCBs shall be provided

with separate lockers or other storage facilities for street clothes and for work clothes.

(b) Employees occupationally exposed to PCBs shall not wear work clothing away from their place of employment.

(c) Employees occupationally exposed to PCBs shall be provided clean work clothing daily, and cleaning establishments shall be informed as to the hazards of handling PCBs and proper disposal procedures for PCB-contaminated waste water.

(d) Facilities for shower baths shall be provided for employees occupationally exposed to PCBs. Workers should shower before changing into street clothes.

(e) Employees exposed to PCBs shall be advised to wash their hands and exposed skin before eating, drinking, smoking or using toilet facilities during the work shift.

(f) Food, drink, or smoking materials shall not be permitted in areas where PCBs are handled, processed, or stored.

#### Section 8 - Monitoring and Recordkeeping Requirements

##### (a) Monitoring

(1) As soon as practicable after the promulgation of a standard based on these recommendations, each employer who manufactures, processes, handles, stores or otherwise uses PCBs shall determine by an industrial hygiene survey whether occupational exposure to PCBs may occur. Surveys shall be repeated at least once every year and within 30 days of any process change likely to result in occupational exposure to PCBs. Records of these surveys, including the basis for any conclusion that there

may be no occupational exposure to PCBs, shall be retained until the next survey has been completed.

(2) If occupational exposure to PCBs is determined to be possible, a program of personal monitoring shall be instituted to measure or permit calculation of the exposures of all employees.

(A) In all personal monitoring, samples representative of the employees' breathing zones shall be collected.

(B) For each TWA concentration determination, a sufficient number of samples shall be taken to characterize each employee's exposure during each work shift. Variations in work and production schedules and in employees' locations and job functions shall be considered in choosing sampling times, locations, and frequencies.

(C) Each operation in each work area shall be sampled at least once every 3 months.

(3) If an employee is found to be exposed to PCBs in excess of the recommended TWA concentration limit, control measures shall be initiated, the employee shall be notified of the exposure and of the control measures being implemented to correct the situation, and the employee shall be monitored every 30 days. Such monitoring shall continue until two such consecutive determinations indicate that the employee's exposure no longer exceeds the recommended TWA concentration limit. Routine monitoring may then be resumed.

(b) Recordkeeping

Environmental monitoring records shall be maintained for at least 30 years after the employee's last occupational exposure to PCBs. These records shall include the dates and times of measurements, job function and

location of employees within the worksite, methods of sampling and analysis used, types of respiratory protection in use at the time of sampling, TWA concentrations found, and identification of exposed employees. Each employee shall be able to obtain information on his or her own environmental exposures. Daily rosters of authorized persons who enter regulated areas shall be retained for 30 years. Environmental monitoring records and entry rosters shall be made available to designated representatives of the Secretary of Labor and of the Secretary of Health, Education, and Welfare.

Pertinent medical records for each employee shall be retained for 30 years after the employee's last occupational exposure to PCBs. Records of environmental exposures applicable to an employee should be included in that employee's medical records. These medical records shall be made available to the designated medical representatives of the Secretary of Labor, of the Secretary of Health, Education, and Welfare, of the employer, and of the employee or former employee.

about 5% of all transformers in the US [27]. Occupational exposure to various askarels used for transformers may occur in their manufacture, servicing, and transportation, or as a result of leaks [29].

Other potential occupational exposures to PCBs exist through losses in storage [30], shipment [29], manufacture and use of heat exchange units [27,31], and in use of previously manufactured items which contain PCBs, such as hydraulic systems, vacuum pumps, and gas transmission turbines [30,31]. The past use of PCBs in carbonless copying papers may result in exposure of workers currently engaged in paper reclamation [30]. Workers in plants that previously used PCBs may have current exposure in their working environments because PCBs have been shown to remain in the workplace air and on surfaces for years after PCB use has been discontinued [32,33]. Several occupations that may have involved exposure to PCBs were tabulated in a 1966 publication [34]. NIOSH estimates that 12,000 workers have potential occupational exposure as a result of current uses of PCBs in their working environments [35].

In addition to their occupational exposures, PCB workers may be exposed to PCBs carried into their homes from the workplace [36], from general contamination of the ambient air [26,37,38] and water [26,37], and to PCBs and their metabolites in their diets [39-46].

#### Metabolism and Mechanism of Action

A study of the metabolism of 4-chlorobiphenyl was reported in 1959 by Block and Cornish [47]. In this experiment, 1 gram of 4-chlorobiphenyl was fed to rabbits in a single dose and 4'-chloro-4-biphenylol and its

NIOSH-indoor - Dr Walt Rusch - 4420502 27

OSHA - <sup>basis</sup> for existing std.

not concerned ab

1 in 100 50 ppm -

Vapor pressure -

evap. Habi & Chem - Physics -

A PCB - with a specific -  
• Hexachlorobiphenyl  
Octo -  
Indeca -

CTY0069258

about 100 ng/cu m were found in Florida and Colorado in 1975 [38].

#### Control of Exposure

The present primary use of PCBs is as dielectric or insulating fluids for electrical capacitors and transformers. Potential hazards of PCBs in these industries result from inhalation and dermal exposures. It is here that engineering controls, such as local exhaust systems, are necessary.

Local exhaust systems should be designed and operated in conformance with American National Standard Z9.2-1971 Fundamentals Governing the Design and Operation of Local Exhaust Systems [246]. Guidelines for handling capacitor and transformer askarels include the following recommendations from the American National Standards Institute (ANSI) [4]: (1) Enclosed systems of sealed piping, properly gasketed joints, valves, containers, and processing chambers should be used for any portion of the operation where askarel temperatures may exceed 55 C; (2) Enclosure should preferably extend to all other portions of the system insofar as practicable; (3) Operations utilizing PCBs should be isolated from other manufacturing areas to avoid cross contamination; (4) Provision should be made for adequate ventilation and regulation of manufacturing operations to avoid open exposure to askarels; (5) When askarels are used at elevated temperatures (especially 55 C or higher), engineering controls must be applied, either by the use of closed systems or by effective local exhaust ventilation with general workroom exhaust.

Durfee et al [247] cited the following potential sources of air emissions of PCBs in transformer and capacitor manufacturing operations: (1) vapor exhaust from stream jet ejectors; (2) evaporation from accidental

spills; (3) evaporation from hot surfaces as part of flood-filling, inspection, or holding operations; (4) vacuum pump exhausts; (5) evaporation from plant waste water.

There are currently no commercially available fluids which can be considered as totally acceptable substitutes for PCBs in the broad range of AC capacitors, nor are there substitute dielectric systems which would satisfy reliability and safety requirements in most applications [28]. Transformers containing PCBs represent only about 5% of the US transformer market, and are used only where safety and reliability are of prime importance. For new installations, building and installation design provisions could be made to accommodate the use of filled, open dry-type, or sealed dry-type transformers. Major construction changes would be required to compensate for the fire resistance of askarel-filled units if existing askarel-filled transformers are to be replaced with oil-filled units of equivalent electrical ratings [4].

#### Environmental Sampling and Analytical Methods

##### (a) Air Sampling

Before discussing the various methods available for sampling airborne PCBs, it is pertinent to discuss the criteria for an ideal sampling device. NIOSH evaluated an industrial worker's exposure and found that sampling in the breathing zone gives a truer picture of actual exposure than does area sampling. The first criterion for an ideal air sampling device then is that it be amenable to personal sampling. In addition, it should be light, compact, and small enough so that workers can pursue their daily activities without being aware of its presence. The second criterion is that the

experimental animals (rabbits, guinea pigs, cats, rats, and mice) exposed to Aroclor 1242 at concentrations of 1.9-8.6 mg/cu m for up to 31 weeks, Ouw et al [196] found evidence of liver injury in workers exposed to Aroclor 1242 at 0.32-1.44 mg/cu m. In their experiments with Aroclor 1254, Treon et al [203] found microscopic evidence of liver injury in animals exposed at 1.5 mg/cu for 31 weeks. Linder et al [228] found increased liver weights in rats fed Aroclor 1254 at 1 ppm for two generations. The intake of PCBs at this dietary level can be compared to the intake from inhalation exposure at about 0.1-0.2 mg/cu m; thus, the animal experiments appear to confirm indications of liver injury in workers exposed to PCBs in this range. The combined studies of Levy et al [197], Meigs et al [190], Hasegawa et al [191], and Ouw et al [196], and the animal studies [203,228], provide further support to the conclusion that PCB exposures must be maintained at lower levels to prevent liver injury than to prevent chloracne.

Since indications of liver injury can be found in reports of both occupational studies [190,191,196] and animal experiments [203,228] with the lowest PCB exposure, there is no proof of an exposure level that is adequately low to prevent liver injury.

The prevention of liver injury is of particular concern because there is substantial evidence that arene oxides are formed during the metabolism of PCBs by animals [51,68,69,74,75,81,115,116,118], and the data offer no reason to suspect that humans metabolize PCBs differently from animals. PCB metabolites have been demonstrated to bind to nuclear components of hepatic cells of rhesus monkeys [51] and rats [81] and this is sufficient evidence to arouse suspicions that PCBs could be potential carcinogens in

the workplace. Commercial PCB preparations that have been adequately tested in rats [218,242] (Federal Register 42:6532-55, February 2, 1977) and mice [221,240,241] have been demonstrated to cause liver tumors. No liver tumors were found in rats fed Aroclors 1242, 1254, and 1260 at 1 ppm in the diet, but each of these mixtures produced tumors at 10 ppm (Federal Register 42:6532-55, February 2, 1977). In this same experiment a high incidence of pituitary tumors was found in PCB-fed rats. In Yusho patients [160,161], and in American workers (written communications, HA Sinclair, June 1976; G Rousch, September 1976), preliminary studies only indicate that the occurrence of certain cancers may be excessive. However, the findings in rats and mice demonstrate reproducible production of liver tumors after ingestion of various PCB mixtures, and NIOSH concludes that PCBs in workplace air are potential carcinogens.

Additional concerns for the health of workers and their families are adverse reproductive effects [228,230,232,233], including terata in animals fed various PCBs (FL Earl et al, written communication, 1976), and adverse effects in human and animal infants nursed by PCB-exposed mothers [101,182,233]. PCBs resembling those in maternal blood both qualitatively and quantitatively have been found in human cord blood and in tissues of newborn humans and animals [101,138,139,168]. Fetal resorptions were common, and dose related incidences of terata were found in pups and piglets when bitches and sows were fed Aroclor 1254 at 1 mg/kg/day or more. Terata were not found in babies of Yusho patients (maximum consumption of PCBs of about 0.15 mg/kg/day); however, many undesirable effects including low birth weights and chloracne-like lesions at birth and after nursing were found [176,182,183].

be related to duration of exposure and to the concentration of residual PCBs in the blood [193].

Although the data indicate that the recommended standard will prevent chloracne, it is not known that it will prevent other skin ailments. NIOSH recommends that in comprehensive physical examinations, special emphasis be given to the condition of the skin.

PCBs fed to bitches and sows have been found to be teratogenic (FL Earl et al, written communication, 1976). Although terata have not been observed in human babies whose mothers had been exposed to PCBs [176,182,183], PCBs have been found in human embryos and fetuses [138,139,168], and undesirable effects (abnormal skin color and low birth weights) have been observed in neonates [176,182,183] born after their mothers had ingested PCBs. A woman who was occupationally exposed to PCBs had a blood PCB concentration of 25 ppb when her normal baby was born [195]. NIOSH considers that its recommended standard will protect unborn babies but recommends that women exposed to PCBs at work be advised of the potential hazards of PCB exposure to unborn children.

PCBs have been found in milk of women who have been exposed to PCBs [168,195] and babies have been adversely affected after being nursed by PCB-exposed mothers [182]. A safe level of PCBs in the milk of mothers occupationally exposed to PCBs is not known. Human milk samples in the general US population usually contain detectable amounts of PCBs, and about one-third of the whole milk samples have been found to contain >50 ppb and up to about 350 ppb (EP Savage, written communication, February 1977). It is not known if all the mothers from whom these samples were taken nursed their babies without effect. Infant monkeys who were nursed by mothers